Mars Environment Sensor Materials

Completed Technology Project (2017 - 2018)

Project Introduction

The project vision is to enable sensors and other components to be durable to the unique low Mars orbital environment so that science and pathfinder data can be reliably and accurately obtained to enable human exploration of Mars. Ground testing capability that can reproduce degradation of sensors observed in the low Mars orbital environment needs to be developed to enable designers to test sensor materials and components prior to flight. It is important to invest in this proposal because we are venturing farther into the solar system where spacecraft are too distant to be easily repaired if something goes wrong. We need to be able to simulate the low Mars orbital environment here so that we select sensor materials that we know will survive a Mars mission prior to launch. It is known that Mars upper atmosphere contains atomic oxygen, but the Mars upper atmosphere is much harsher than was originally thought. Langmuir probe sensor surfaces tested under Low Earth Orbit (LEO) atomic oxygen conditions for the MAVEN (Mars Atmosphere and Volatile EvolutioN) mission, which performed under LEO environment conditions, experienced unexpected loss in performance in low Mars orbit. The goal is to understand the cause of degradation of Langmuir probe and other sensor materials observed on the MAVEN spacecraft and develop a capability to simulate the degradation on the ground to enable development of Mars environment durable sensors.

Anticipated Benefits

The ability to simulate the low Mars orbital environment on Earth and reproduce degradation observed for sensors on MAVEN has the potential to significantly improve sensor performance for future low Mars orbital missions by providing information to make them stable and more reliable. This enables more accurate measurements of fields and currents in low Mars orbit which leads to improvement of models and reduction of risk for manned missions in the future.

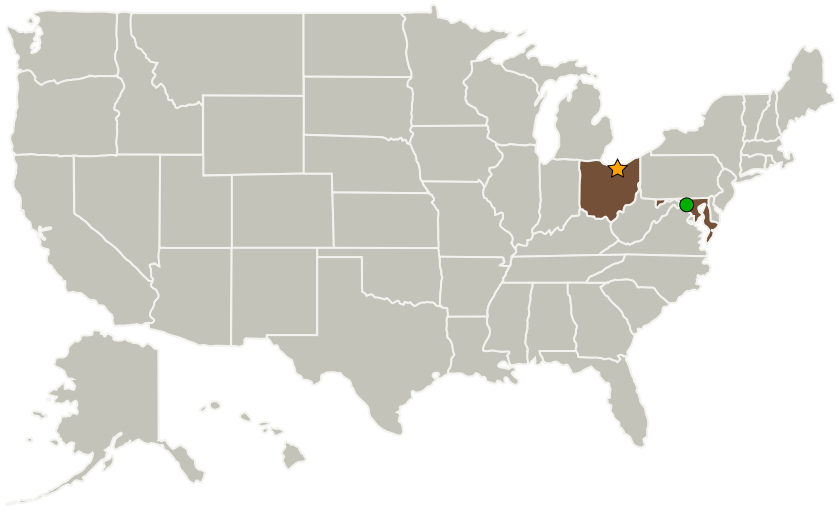
Mars Environment Sensor Materials

Table of Contents

Mars Environment Sensor Materials

Completed Technology Project (2017 - 2018)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
●Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado

Primary U.S. Work Locations	
Maryland	Ohio

Project Transitions

October 2017: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Center Innovation Fund: GRC CIF

Project Management

Program Director:

Michael R Lapointe

Program Managers:

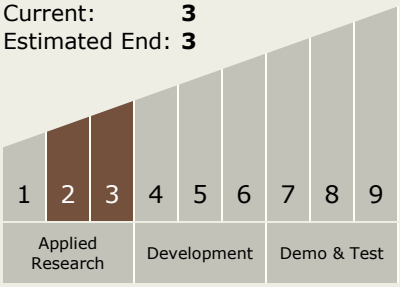
Kurt R Sacksteder
Gary A Horsham

Principal Investigator:

Sharon K Miller

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Mars Environment Sensor Materials

Completed Technology Project (2017 - 2018)

September 2018: Closed out

Closeout Summary: The goal of the project was to understand the cause of unexpected degradation of the Langmuir probe and other sensor materials observed on the MAVEN (Mars Atmosphere and Volatile Evolution) spacecraft and develop a capability to simulate the degradation on the ground to enable development of Mars environment durable sensors. The current maturity is TRL 3. More testing is needed to understand the difference in material interactions with the LEO and LMO environments, and to test active sensors in the LMO environment in order to replicate the changes that were observed on MAVEN before the results can be used to develop more durable sensor surfaces.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VC

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.1 Destination Reconnaissance and Resource Assessment

Target Destination

Mars